

CLAIMS

1. A device avatar system for providing at least one electronic service for a first physical electronic device associated with a first device avatar using at least one channel of electronic communication, the system comprising:
 - an avatar hosting infrastructure, having disposed therein at least the first device avatar, for providing an encapsulated autonomous system for facilitating communication between the first device avatar and the first physical electronic device;
 - the first device avatar, coupled to receive at least communications from a first controller, for providing the at least one electronic service to the first physical electronic device;
 - the first controller, coupled to the first device avatar, for an owner of the associated physical electronic device to implement the at least one electronic service for the first physical electronic device; and
 - the first physical electronic device, coupled to the first device avatar, for operating in a predetermined fashion in accordance with the at least one electronic service.
2. The system of claim 1 wherein the first physical electronic device is coupled to the first device avatar via the Internet.
3. The system of claim 1 further including a second device avatar, coupled to a second physical electronic device and to receive communications from a second controller, for providing an electronic service associated with the second physical electronic device to the first physical electronic device.

4. The system of claim 1 wherein the first physical electronic device is one of: a camera, a scanner, measurement equipment, a personal digital assistant, and a computer.
5. The system of claim 3 wherein the second physical electronic device is one of: a printer and a display screen.
6. The system of claim 1 wherein the avatar hosting infrastructure is an independent electronic data processing apparatus.
7. The system of claim 1 wherein the avatar hosting infrastructure includes secured partitions for each physical electronic device within an electronic data processing apparatus.
8. The system of claim 1 wherein communications are one of: bi-directional, outbound uni-directional from the avatar hosting infrastructure, and inbound uni-directional to the avatar hosting infrastructure.
9. An avatar hosting infrastructure for providing at least one of a plurality of electronic services logically and substantially permanently associated with a first remote electronic device wherein the at least one of the plurality of electronic services is operated on behalf of the first remote electronic device, comprising:
 - an electronic data processing apparatus having a first device avatar that is coupled to a first control unit and to the first remote electronic device, wherein the first device avatar includes at least a first memory coupled to a first processor that implements the at least one of the plurality of electronic services on behalf of the first remote electronic device in accordance with signals from the first control unit.

10. The avatar hosting infrastructure of claim 9 wherein the first remote electronic device is coupled to the first device avatar via the Internet.
11. The avatar hosting infrastructure of claim 9 wherein the electronic data processing apparatus further includes a second device avatar, coupled to a second remote electronic device and to receive communications from a second control unit, for providing an electronic service associated with the second remote electronic device to the first remote electronic device.
12. The avatar hosting infrastructure of claim 9 wherein the first remote electronic device is one of: a camera, a scanner, measurement equipment, a personal digital assistant, and a computer.
13. The avatar hosting infrastructure of claim 11 wherein the second remote electronic device is one of: a printer and a display screen.
14. The avatar hosting infrastructure of claim 11 wherein the avatar hosting infrastructure includes secured partitions for each remote electronic device within the electronic data processing apparatus.
15. The avatar hosting infrastructure of claim 1 wherein the electronic services are implemented in one of the following directions: bi-directional, outbound uni-directional from the avatar hosting infrastructure, and inbound uni-directional to the avatar hosting infrastructure.
16. A method for implementing at least one of a plurality of electronic services logically and substantially permanently associated with a first remote electronic device wherein the at least one of the plurality of electronic services is operated on behalf of the first remote electronic

device using a logical channel of communication, comprising the steps of:

- connecting to a device avatar, by an apparent owner, via a Controller Listener;
- issuing, by the apparent owner, a challenge to the device avatar;
- accessing, by the device avatar, from a Controller Key Storage via a Controller State Machine, an owner key and using a Challenge Generator to generate a challenge of the apparent owner;
- issuing a successful response, by the apparent owner, to the challenge by the device avatar; and
- issuing, by the device avatar, a response to the challenge of the apparent owner by the Controller State Machine using a Response Generator and a device key in the Controller Key Storage to indicate that the connection is approved for a correct device avatar.

17. The method of claim 16, further including requesting, by the apparent owner, a behavior of one of a plurality of behaviors stored in the Store of Inherent Behaviors, and invoking, by the Controller State Machine, the behavior requested and reporting results to the apparent owner.
18. The method of claim 17 wherein the Inherent Behaviors fail to disclose a private key of the device avatar, fail to alter any private key of the device avatar and include:
 - updating an apparent owner key in the Controller Key Storage;
 - updating a contents of a Store of Acquired Behaviors;
 - receiving a contract;
 - listing received contracts;
 - issuing a contract;
 - listing issued contracts;
 - invoking an acquired behavior;
 - manipulating Controller Data Storage;

manipulating Device Data Storage;
manipulating Interpreter Data Storage;
monitoring a Device State;
resetting the Device State;
monitoring Interpreter State; and
resetting Interpreter State.

19. A method for implementing at least one of a plurality of electronic services logically and substantially permanently associated with a first remote apparent electronic device wherein the at least one of the plurality of electronic services is operated on behalf of the first remote apparent electronic device using a logical channel of communication, comprising the steps of:
- connecting to a device avatar, by an apparent electronic device, via a Device Listener;
 - issuing, by the apparent electronic device, a challenge to the device avatar;
 - accessing, by the device avatar, from a Device Key Storage via a Device-specific State Machine, a device key and using a Challenge Generator to generate a challenge of the apparent electronic device,
 - issuing a successful response, by the apparent electronic device, to the challenge by the device avatar; and
 - issuing, by the device avatar, a response to the challenge of the apparent electronic device by the Device-specific State Machine using a Response Generator and a device key in the Device Key Storage to indicate that the connection is approved for a correct device avatar.
20. The method of claim 19, further including requesting, by the apparent owner, a behavior of one of a plurality of behaviors stored in the Store of Inherent Behaviors, and invoking, by the Device-specific State Machine, the behavior requested and reporting results to the apparent electronic device.

21. The method of claim 20 wherein the Inherent Behaviors include:
- reporting to the apparent electronic device an action it is requested to perform;
 - accepting status information for the apparent electronic device;
 - sending data to the device from a Device Data Storage; and
 - receiving data from the apparent electronic device into the Device Data Storage.
22. A method for implementing, via a second device avatar in fulfillment of a contract for services previously issued by a first device avatar, at least one of a plurality of electronic services logically and substantially permanently associated with a first remote electronic device wherein the at least one of the plurality of electronic services is operated on behalf of the first remote electronic device using a logical channel of communication, comprising the steps of:
- connecting to the first device avatar, by a remote entity, via a Service Listener in preparation for fulfilling the contract for services previously issued by the first device avatar;
 - issuing, by the remote entity, a challenge to the first device avatar based on an issuer's key included in the contract;
 - examining, by a Contract Interpreter, the contract to verify the contract's applicability by comparing at least an expiration time with a current time referring to a Clock and a number of valid invocations remaining;
 - providing a response, by the Contract Interpreter, to the challenge to the first device avatar; and
 - carrying out terms of the contract, by the Contract Interpreter, by invoking acquired behaviors in a number, order and manner specified by the contract and as resident in a Store of Acquired Behaviors.
23. The method of claim 22 wherein the remote entity is a second device avatar.

24. The method of claim 22 wherein the contract includes primitives that include at least one of: control structures, logical and arithmetic operations and acquired behaviors whose identities are referenced in the contract without internal structures.
25. The method of claim 24 wherein the acquired behaviors include a restricted set of inherent behaviors that include at least:
- sending data to the remote entity from an Interpreter Data Storage;
 - receiving data from the remote entity into the Interpreter Data Storage; and
 - invoking a received contract.
26. A method for implementing, via a recipient device avatar in fulfillment of a contract for services previously issued by an issuer device avatar, at least one of a plurality of electronic services logically and substantially permanently associated with a first remote electronic device wherein the at least one of the plurality of electronic services is operated on behalf of the first remote electronic device using a logical channel of communication, comprising the steps of:
- initiating, by the recipient device avatar, communications to a Services Listener of the issuer device avatar specified in the contract;
 - issuing, to the recipient device avatar, a challenge by the issuer device avatar based on an issuer device avatar key included in the contract;
 - responding, by the recipient device avatar, to the challenge of the issuer device avatar based on a recipient device avatar key included in the contract; and
 - implementing, by the recipient device avatar, at least one electronic service in accordance with the contract.

27. The method of claim 26 further including, prior to initiating, by the recipient device avatar, communications to a Services Listener of the issuer device avatar specified in the contract, a step of outsourcing the contract to a non-contract recipient and invoking, by the non-contract recipient, the contract by outsourcing, to the recipient device avatar, the response to the issuer.